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MARKETS, TRADE AND INSTITUTIONS DIVISION

May 2006

MTID Discussion Paper No. 96

Philippine Rice and Rural Poverty: An Impact Analysis of Market Reform Using CGE

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ABSTRACT

This paper looks at how Philippine trade reform which consists of tariff reduction and elimination of quantitative restrictions (QR) on rice imports will affect poverty within two world trade scenarios: Doha and free world trade. The impact of Doha is very small and generates biased effects against agriculture. The impact of Philippine trade reform within the Doha agenda magnifies this biased effect, making rural households worse-off compared to urban households. However, eliminating rice QR generates a set of effects where consumer price reduction dominates nominal income decline. Thus, real income improves and poverty declines across household groups, but the net effects are lower in rural than in urban households. The impact of a free world trade economy is favorable in terms of higher export prices and export demand for agriculture and agriculture-related manufacturing industries. This mitigates the biased effects against agriculture, and is therefore favorable to rural households. However, if Philippine trade reform is added to the analysis, the result switches back to the previous biased effects on agriculture and on rural households.

Keywords: Rice, Agriculture, Poverty, Philippines, CGE Model
JEL Codes: F1, I3, N5, O5, Q0, Q1

PHILIPPINE RICE AND RURAL POVERTY: AN IMPACT ANALYSIS OF MARKET REFORM USING CGE

Caesar B. Cororaton

1. INTRODUCTION

The objective of the paper is to examine the poverty effects, particularly rural poverty, of trade reform which consists of tariff reduction across sectors and elimination of quantitative restrictions (QR) on rice imports within the Doha Development Agenda (DDA) and a free trade world economy. We adopt a two-step approach wherein we utilize the simulation results of the GTAP[1] model concerning the possible effects of changes in world trading arrangements on Philippine foreign trade, and then translate these to determine the impact on the local economy and poverty using a static one-period Philippine computable general equilibrium (CGE) model. We discuss the structure of Philippine rice and highlight changes in production structure over time and the importance of rice to Filipino households, particularly to poor households. We also discuss the basic features of the CGE model used, the definition policy experiments conducted, and the results generated.

[1]Global Trade Analysis Project (Hertel, 1997).

2. THE RICE SECTOR

2.1 RICE POLICY

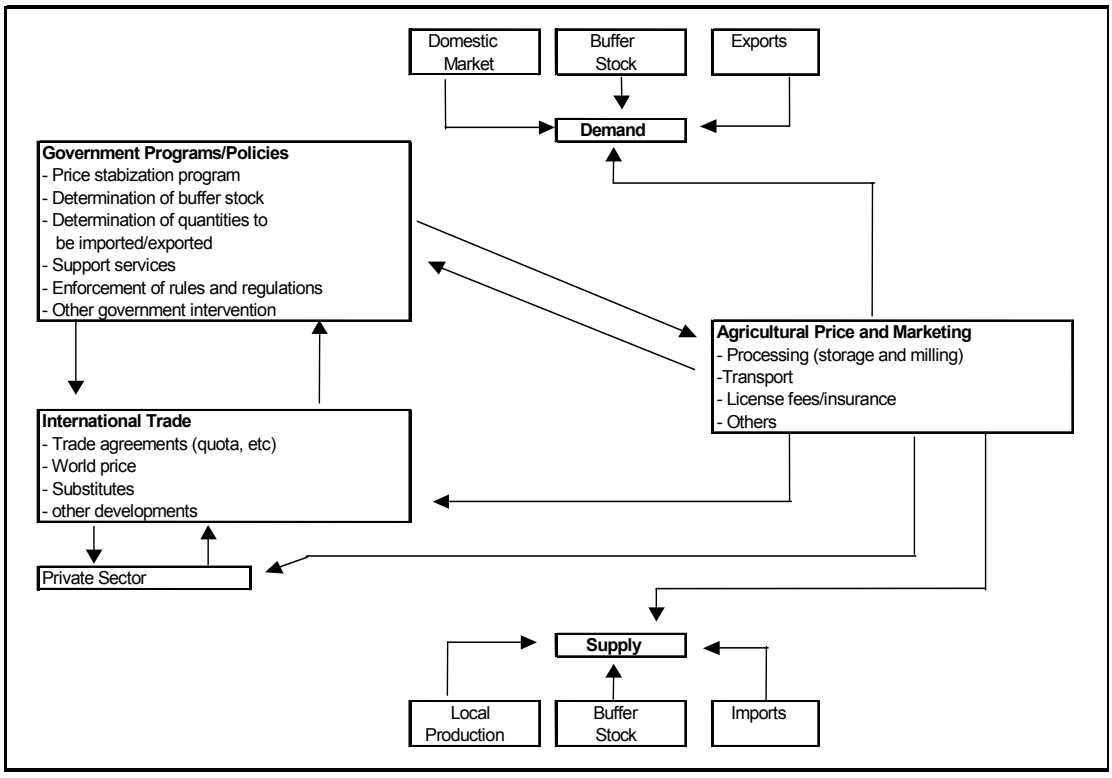
Rice is the staple food for about 80 percent of Filipinos, and is therefore a major item in the consumption basket of consumers. It is the single most important agricultural crop in the Philippines, and is therefore a major source of income for millions of Filipino farmers. Because of its political significance, the government is heavily involved in supply and distribution to assure consumers a sufficient and stable supply at low prices and to maintain a reasonable return to rice farmers with adequate price incentives.

There are three major factors affecting the supply of rice: local production, buffer stock, and imports. There are also three factors influencing the demand side: domestic market, buffer stock and exports. The two major policy instruments used by the government to influence the rice sector are tariff and QR on rice imports[2]. Figure 1 is a diagram which shows how government interventions may have influenced activities in rice. The present pricing policy of the government involves the setting and defending of price floor and price ceiling. It also minimizes seasonal price variations in the various regions. Furthermore, the government monopolizes the importation and exportation of rice through its various procurement and disbursement operations in order to influence domestic price levels. Currently, government interventions are implemented through the

[2]The Philippines is one of the three countries granted in 1995 exemption from the removal of QR on rice under Annex 5 of the World Trade Organization (WTO) agreement. Japan and South Korea are the other two countries. The exemption is set to expire in the middle of 2005. To date, the Philippine government is negotiating with other South East Asian rice-producing countries for support for possible extension in the WTO.

National Food Authority (NFA), which is an attached agency of the Department of Agriculture. The NFA took over the operation of the National Grains Authority (NGA), which was in operation from 1972 to 1981. The administration of NGA in turn succeeded the Rice and Corn Administration, which operated from 1962 to 1972.

Figure 1—Rice activities



Source: Chupungco (1991)

The literature shows that the government policy on rice is more successful in defending consumer price ceilings than price floors. As a result, farm prices remained below palay support prices. This is due to inadequate NFA procurement budget and delays in NFA purchases. Thus, margins are squeezed, resulting in reduced investment in

post-harvest facilities and less planting given the unattractive price to farmers. On the other hand, in the long-run the consumer-oriented pricing policy fails to benefit consumers as it reduces rice availability. The partial equilibrium analysis of Roumasset (2000) indicates that the excess burden of the rice policy amounted to P48.79 billion in 1999. This estimate does not account for the financial cost of subsidies to the NFA. In 1999, ADB approved a loan facility amounting to US$75 million to support grain policy reform in the Philippines, called the Grains Sector Development Program (GSDP).[3] The policy framework of GSDP focused on: (i) liberalizing and instituting more cost effective grains pricing and import policies; (ii) improving the administration of grain buffer stocks; (iii) restructuring the NFA from a grains marketing monopoly into a public regulatory agency and separate private sector marketing corporation; and (iv) implementing a well-targeted and effective food subsidy program for the poor.

[3]However, the loan facility was cancelled because of unmet conditionalities.

Table 1—Contribution of agriculture to GDP (%)

	1993	1997	2003
1. Agriculture, Fishery, Forestry	21.7	18.7	14.5
a. Agriculture	17.4	15.8	12.3
Palay	2.9	3.0	2.2
Corn	1.2	0.9	0.6
Coconut including copra	1.3	1.0	0.7
Sugarcane	0.7	0.5	0.4
Banana	0.7	0.5	0.5
Other crops	5.2	4.9	3.9
Livestock	2.7	2.5	1.9
Poultry	1.9	1.5	1.3
Agricultural activities & services	1.0	0.9	0.7
b. Fishery	3.9	2.8	2.2
c. Forestry	0.4	0.1	0.1
2. Industry Sector	32.9	32.2	32.3
Rice and Corn Milling /a/			
3. Service Sector	45.4	49.1	53.2
Gross Domestic Product	100.0	100.0	100.0

Source: National Statistical Coordination Board

/a/ in 1994 Input-Output Table its contribution to total value added was about 2.3%

2.2 RICE PRODUCTION AND PRICE STRUCTURE

The contribution of palay production (unhusked rice) to the gross domestic product (GDP) ranges from 2 to 3 percent over the last 10 years, while the share of 'rice and corn milling', which is under the industrial sector, is about 2.3 percent (Table 1). Among agricultural crops, cereals production, particularly palay, dominates in terms of area planted, volume of production and value of output (Table 2). From 1993 to 2002, more than 50 percent of agricultural area was planted with palay and corn. In recent years, the share of palay production increased in terms of area planted and quantity produced, as well as in terms of value of output. In 2002, about 38 percent of the value of output of agricultural crops came from palay production.

There are two varieties of palay grown: modern variety (MV) and traditional variety (TD). Over the last three decades, the share of MV production has almost doubled from 55 percent in 1970 to 96 percent in 2002 (Table 3). The production of MV palay is more productive than TV in terms of yield per hectare. In 1970, the average productivity of MV production was 1.93 metric tons per hectare, compared to 1.51 for TV. During the last three decades, both saw a steady upward trend, with MV's productivity increasing to 3.36 metric tons per hectare in 2002 and TV's to 2.11.

Table 2—Agriculture production (% distribution)

	1993			1997			2002 /p		
	Area	Quantity	Value	Area	Quantity	Value	Area	Quantity	Value
A. Cereals	51.4	21.7	40.9	51.7	22.8	41.6	50.1	24.2	47.2
Palay	26.3	14.4	28.6	30.3	16.5	31.6	31.5	18.2	37.9
Corn	25.2	7.3	12.3	21.5	6.3	10.0	18.6	5.9	9.3
B. Major Crops	38.4	64.9	41.9	39.0	68.6	44.9	45.9	71.7	45.5
Coconut	24.6	17.3	13.2	24.7	20.1	12.0	31.8	18.8	11.6
Sugarcane	3.1	34.9	5.5	3.0	32.6	5.5	2.9	37.4	7.0
Banana	2.6	4.8	6.0	2.7	6.5	7.0	3.1	7.2	9.4
Pineapple	0.3	2.0	3.1	0.3	2.4	4.0	0.4	2.2	3.3
Mango	0.5	0.6	3.6	1.0	1.4	5.6	1.1	1.3	4.8
Other major crops	7.3	5.4	10.6	7.3	5.6	10.8	6.6	4.7	9.3
Other Crops	10.1	13.4	17.2	9.3	8.6	13.5	3.9	4.1	7.2

Source: Philippine Statistical Yearbook
/p: preliminary

There are two types of ecosystem in palay production: irrigated and non-irrigated (rainfed and upland). The last three decades saw a significant shift to irrigated palay farming, from 55 percent in 1970 to 75 percent in 2002 (Table 4). Irrigated palay farming is more productive than non-irrigated. In 2002, the former had an average yield of 3.71 metric tons per hectare, while the latter was 2.48 (Table 3).

Table 3—Palay production (distribution, %)

		Production			Area Harvested			Yield (mt/ha)		
		Total	MV	TV	Total	MV	TV	Total	MV	TV
All Ecosystem	1970	100	55	45	100	48	52	1.71	1.93	1.51
	1980	100	85	15	100	78	22	2.20	2.42	1.45
	1990	100	93	7	100	89	11	2.81	2.94	1.77
	2002	100	96	4	100	94	6	3.28	3.36	2.11
Irrigated	1970	100	68	32	100	66	34	2.06	2.12	1.94
	1980	100	91	9	100	88	12	2.80	2.90	2.10
	1990	100	95	5	100	93	7	3.29	3.35	2.36
	2002	100	98	2	100	97	3	3.68	3.71	2.63
Rainfed	1970	100	38	62	100	33	67	1.42	1.61	1.32
& Upland	1980	100	77	23	100	69	31	1.69	1.89	1.24
	1990	100	88	12	100	82	18	2.07	2.21	1.43
	2002	100	91	9	100	88	12	2.48	2.57	1.80

Source: Philippine Rice Statistics
mt is metric tons, ha is hectares, MV is modern variety and TV is traditional variety

Table 4—Irrigated & non-Irrigated (distribution, %)

	Palay Production			Area Harvested		
	Total	Irrigated	Non-Irrigated	Total	Irrigated	Non-Irrigated
1970	100	55	45	100	46	54
1975	100	54	46	100	41	59
1980	100	59	41	100	46	54
1985	100	66	34	100	56	44
1990	100	71	29	100	61	39
1995	100	72	28	100	62	38
2002	100	75	25	100	67	33

Source: Philippine Rice Statistics

Rice is mainly used for food consumption (Table 5). In 2002, about 88.4 percent of the production was consumed as food. There are two sources of rice: local production and imports. During the last ten years, local production has become less and less able to meet local demand because of high population growth. Thus, rice imports increased from 412,000 metric tons in 1990 to 886,000 metric tons in 2002. There was, however, a blip

in 1998, largely due to the sharp drop in palay production because of El Nino. In 1998, imported rice amounted to 1,871,000 metric tons.

Table 5—Production and utilization of rice

	Production	Production Utilization (' 000 mt)				Surplus/ (Deficit) /a/	Population
	(' 000 mt)	Total	Food	Seeds	Feeds & Wastes	(' 000 mt)	('000)
1970	3,246	3,367	3,014	142	211	(120)	36,852
1975	3,988	4,262	3,833	170	259	(274)	42,259
1980	4,970	4,945	4,453	169	323	25	48,317
1985	5,759	5,693	5,156	162	374	67	54,257
1990	6,095	6,507	5,949	163	396	(412)	60,910
1995	6,852	7,182	6,553	183	445	(330)	68,349
1996	7,335	7,865	7,195	193	477	(530)	69,952
1997	7,325	7,878	7,214	187	476	(553)	71,550
1998	5,561	7,432	6,719	212	500	(1,871)	73,267
1999	7,661	8,410	7,396	286	728	(749)	74,990
2000	8,053	8,891	7,837	289	765	(838)	76,764
2001	8,421	9,124	8,033	291	800	(703)	78,561
2002	8,626	9,511	8,403	289	819	(886)	80,429

Source: Philippine Rice Statistics
/a/ Supplied by imports

Table 6— Relative distribution of Palay production utilization and disposition of farm households, %

	Landlord's Share	Sold	Food	Seeds	Feeds	Others*	Total
1970	20	22	35	3	1	18	100
1975	14	28	41	3	1	14	100
1980	13	39	34	3	1	11	100
1985	2	39	30	3	0	14	100
1990	10	41	30	4	1	15	100
1995	8	42	31	-	-	18	100
1997	9	44	29	-	-	17	100
2002	7	49	26			18	100

Source: Philippine Rice Statistics
* Seeds and/or feeds

Data on the disposition of palay production by farm households indicate that 22 percent of production was sold to the market in 1970, and 35 percent was used for personal food consumption (Table 6). The structure changed dramatically over time. In 2002, 49 percent of palay production of farm households was sold to the market, while the share for personal food consumption dropped to 26 percent. This trend implies that palay activities have become market oriented, and therefore increasingly vulnerable to market changes.

Table 7—Fertilizer use

		Area Planted (' 000 hectare)	Area Applied		Average Fertilizer Use per hectare (bag of 50 kg)
			Area	%	
Irrigated	1991	1,046	947	90.5	3.8
	1995	1,183	1,108	93.7	4.1
	1998	1,133	1,013	89.4	4.6
	2002	1,357	1,314	96.9	4.9
Rainfed	1991	698	489	70.0	3.3
	1995	724	488	67.3	3.6
	1998	507	325	64.0	3.6
	2002	675	536	79.5	3.8

Source: Philippine Rice Statistics

Fertilizer is a critical input into palay production. Of the total area irrigated area planted with palay in 1991 about 90.5 percent applied fertilizers. In 2002, the ratio improved to 96.9 percent, translating to an average use of 4.9 50-kilogram bags of fertilizer[4] per hectare. However, the intensity of fertilizer use in non-irrigated farms less is than in irrigated farms.

[4]Including Urea, Ammosul, Complete, Ammopohos, and others.

Table 8—National food authority's Palay procurement and rice injection

	Palay (' 000 mt)			Rice (' 000 mt)		
	Procurement	Production		Injection	Supply	
	(a)	(b)	(a)/(b), %	(c)	(d)	(c)/(d), %
1975	233	6,381	3.7	227	4,262	5.3
1980	551	7,646	7.2	280	4,945	5.7
1985	401	8,806	4.6	365	5,693	6.4
1990	572	9,319	6.1	667	6,507	10.2
1995	555	10,541	5.3	257	7,182	3.6
1996	420	11,284	3.7	733	7,865	9.3
1997	155	11,269	1.4	623	7,878	7.9
1998	61	8,555	0.7	1,627	7,432	21.9
1999	8	11,787	0.1	1,372	8,410	16.3
2000	124	12,389	1.0	1,164	8,891	13.1
2001	101	12,955	0.8	813	9,124	8.9
2002	62	13,271	0.5	1,239	9,511	13.0

Source: Philippine Rice Statistics

Government intervention in rice is through NFA's procurement of palay from the farmers and rice injections into the market. The former protects farmers from low market prices of palay and therefore assures them of adequate income, while the latter protects the general consuming public from high market prices for rice. On the procurement side, data indicate that NFA's intervention has declined through time from 7.2 percent of total production in 1980 to 0.5 percent in 2002 (Table 8). This is largely due to NFA's budgetary problems.[5] On the other hand, NFA's rice injection into the system has been relatively significant. Its rice injection into the market reached a peak of 21.9 percent in 1998 due to the drop in palay production because of El Nino. Rice injection, however, stabilized since then, but still significant at 13 percent in 2002.

We assembled a set of data from various official sources to get a picture of the

[5]To date, NFA is saddled with huge financial losses.

price structure. Table 9 presents official estimates of the cost of drying, milling, and transporting palay from farm to the place of processing. The cost of transporting varies depending upon the location of the farm. Within flat terrain and within mountainous areas the cost is flat rate, but the former is a bit lower than the latter. Outside these areas, the cost varies with distance.

We used Table 9 in constructing the set of prices in Table 10. In Column (A) we considered the cost of mechanical drying only, but converted it to pesos per kilo. In Column (B) we took the average cost of milling using the two methods: cono and kiskisan. However, we need information about the exact distance between the farms and the processing sites to be able to derive the transportation cost. Since this is not available we assumed a range: 30 and 60 kilometers. Thus, Column (C) is derived through the following steps: (i) we converted Columns (5) to (8) in Table 9 into pesos/kilo; (ii) we multiplied the results for Columns (6) and (8) by 30-kilometer distance; and (iii) we took the average of the results of Columns (6) to (8). Column (D) is similar, except that we multiplied the transportation cost by 60-kilometer distance.

Column (G) is the actual farmgate price of palay. We added the cost of drying, milling and transporting palay to the farmgate gate price to get the cost of processed rice, which is presented in Columns (H) and (I). Furthermore, we added 10 percent more to account for other costs. The results are in Columns (J) and (K). The actual retail price of ordinary rice is shown in Column (L). Note that the actual retail price is about 70 percent higher than the cost of processed rice over the period 1996-2002.

How does this price structure compare with the price of imported rice? Column

(M) shows the FOB world price of rice for 35 percent broken. This type of rice is comparable to ordinary rice produced in the country. We expressed the numbers in kilogram and in local currency using the nominal exchange rate. Column (N) is the ratio of the CIF and the FOB value of rice imports into the Philippines. Column (O) is Column (M), but adjusted by Column (N). We label this as the price of imported rice at the border. Column (P) is the nominal tariff rates on imported rice, which has declined from 53.5 percent in 1996 to 41.0 percent in 2002. Column (Q) shows the domestic price of imported rice after tariff.

Table 9—Costs of drying, milling and transporting Palay

	Drying		Milling		Transporting			
					Flat Terrain		Mountainous	
	Solar	Mechanical	Cono	Kiskisan	Within /a/	Outside /b/	Within /a/	Outside /b/
	(P/50-kg bag input)		(Peso/50-kg bag)		(Peso/50-kg bag/km)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1987	2.22	6.10	16.22	15.46	0.45	0.24	-	0.36
1988	1.96	4.39	17.41	15.66	0.33	0.20	0.57	0.29
1989	2.41	6.70	17.37	19.50	0.35	0.13	0.62	0.20
1990	2.42	7.89	21.27	20.98	0.41	0.22	0.62	0.21
1991	2.12	14.75	29.35	29.40	0.34	0.14	0.47	0.20
1992	2.22	12.34	29.92	30.15	0.32	0.17	0.38	0.23
1993	2.39	12.49	30.65	31.35	0.32	0.18	0.46	0.23
1994	3.09	11.23	29.89	30.05	0.31	0.18	0.37	0.25
1995	3.73	14.07	31.15	31.50	0.31	0.19	0.36	0.24
1996	3.68	14.68	32.21	32.24	0.33	0.25	0.42	0.33
1997	4.08	16.62	34.26	33.86	0.37	0.33	0.43	0.36
1998	4.39	17.61	36.82	36.09	0.40	0.33	0.40	0.43
1999	4.93	19.70	38.43	38.24	0.56	0.31	-	0.40
2000	5.38	22.14	40.37	41.36	0.43	0.35	-	0.41
2001	5.88	24.56	43.78	44.14	0.48	0.34	-	0.49
2002	6.06	27.77	46.19	46.89	0.53	0.38	0.56	0.45

Source: Philippine Rice Statistics 1970-2002
/a/ flat rate; /b/ per kilometer basis

Table 10—Prices of rice in pesos per kilo gram

	Drying Mechanical	Milling Average of cono & kiskisan	Transport Cost Average of all terrain		Total 1		Farmgate palay price	Total 2		Total 2 +10%		Actual average retail price of rice	World Price of Rice (35% broken) FOB	Ratio of CIF & FOB value of rice imports	Price of rice at the border	Nominal tariff on rice imports (%)	Domestic price of imported rice after tariff	Actual vs imported price at the border (%)	Trade distortion other than tariff (%)
			km = 30	km = 60	km = 30	km = 60		km = 30	km = 60	km = 30	km = 60								
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
1987	0.122	0.317	0.123	0.243	0.562	0.682							4.2						
1988	0.088	0.331	0.078	0.198	0.497	0.617							5.7						
1989	0.134	0.369	0.054	0.134	0.557	0.637	3.2					7.9	6.3						
1990	0.158	0.423	0.070	0.175	0.650	0.755						8.9	6.0						
1991	0.295	0.588	0.055	0.138	0.938	1.021						9.1	6.6						
1992	0.247	0.601	0.064	0.162	0.911	1.010						9.7	5.9						
1993	0.250	0.620	0.065	0.166	0.935	1.036						10.8	5.5						
1994	0.225	0.599	0.068	0.174	0.892	0.998						12.2	9.2						
1995	0.281	0.627	0.068	0.174	0.976	1.082						15.1	7.5	9.3	8.2			85.7	
1996	0.294	0.645	0.091	0.234	1.029	1.172	7.54	8.6	8.7	9.4	9.6	17.1	7.2	5.1	7.6	53.5	11.7	125.2	71.7
1997	0.332	0.681	0.107	0.277	1.121	1.291	7.52	8.6	8.8	9.5	9.7	16.5	7.3	8.9	7.9	49.8	11.9	108.4	58.6
1998	0.352	0.729	0.118	0.307	1.199	1.388	8.08	9.3	9.5	10.2	10.4	17.1	10.2	10.4	11.3	48.6	16.8	51.5	3.0
1999	0.394	0.767	0.146	0.288	1.306	1.448	7.69	9.0	9.1	9.9	10.1	17.3	8.2	9.8	9.1	45.0	13.1	90.6	45.6
2000	0.443	0.817	0.155	0.307	1.415	1.567	7.50	8.9	9.1	9.8	10.0	17.6	7.4	10.0	8.1	44.3	11.7	116.9	72.6
2001	0.491	0.879	0.169	0.335	1.540	1.706	7.90	9.4	9.6	10.4	10.6	17.5	7.6	12.2	8.5	44.3	12.3	105.9	61.6
2002	0.555	0.931	0.130	0.336	1.616	1.822	8.33	9.9	10.2	10.9	11.2	18.0	8.8	9.4	9.6	41.0	13.6	86.6	45.6
2003													9.6						

Notes:

(A) Column (2) in Table 9 converted into pesos/kilogram

(B) Average of columns (2) & (3) in Table 9 converted into pesos/kilogram

(C) Average of columns (5) to (8) in Table 9 converted into pesos/kilogram with assumption that distance is 30 kilometers

(D) Average of columns (5) to (8) in Table 9 converted into pesos/kilogram with assumption that distance is 60 kilometers

(E) Total 1 = (A) + (B) + (C)

(F) Total 1 = (A) + (B) + (D)

(G) Sourced from Philippine Rice Statistics

(H) Total 2 = (E) + (G)

(I) Total 2 = (F) + (G)

(J) Column (H) + 10% to cover other costs

(K) Column (I) + 10% to cover other costs

(L) Sourced from Philippine Rice Statistics

(M) Source: World Bank (FOB Bangkok; in pesos)

(N) Ratio in % of CIF and FOB value of rice imports into the Philippines

(O) is (M) adjusted by (N)

(P) Sourced from Tariff Commission

(Q) is (O) adjusted by (P)

(R) Ratio in % of (L) and (Q)

(S) Column (R) less (P)

We compare both the total cost of processed rice (Columns (J) and (K)) and the actual retail price of ordinary rice in Column (L) with the price of imported rice at the border in Column (O). The first comparison indicates the price competitiveness of domestically produced rice, while the second comparison captures all other price distortions in the rice market.

The cost of producing rice domestically is slightly higher than the cost of importing rice (Columns (J) and (K) versus Column (O)). Based on our estimates, the cost difference is between 13 and 15 percent over the period 1996-2002.

The price distortion in the domestic market is indeed huge (Column (L) versus Column (O)). In 1996, the difference is 125 percent (Column (R)). In 1998, the difference dropped to 51 percent, primarily due to the adjustment in the exchange rate because of the effects of the Asian financial crisis. After 1998, the difference bounced back to about 100 percent. Part of the distortion is the nominal tariff in Column (P). If we net out tariff, we get the effects of other distortions, which is largely due to QR. This is shown in Column (S). The contribution of other distortions is also substantial, more than 50 percent, except in 1998 because of the depreciation of the local currency.

3. FOOD AND POVERTY

About half of rural households live below poverty, while one-fifth of urban households fall below the poverty threshold (Table 11). More than 60 percent of expenditure of rural poor households is on food; about half is on cereals, consisting of rice and corn, with the former having a much larger share. An almost similar structure is observed in the expenditure pattern of urban poor households. On the other hand, grains production utilizes most agricultural resources. In particular, about 5 million hectares of arable land are devoted to rice and corn production, with two-thirds under palay. Furthermore, majority of the rural population – about 1.8 million people – depend on the grains sector.

Table 11—Food and poverty

	Rural				Urban			
	1997	**2000**			**1997**	**2000**		
Pov. Incidence	50.7	48.8			21.6	18.6		
	Poor		**Non poor**		**Poor**		**Non poor**	
Consumption %*	1997	2000	1997	2000	1997	2000	1997	2000
Food	63.6	63.6	47.6	47.6	61.4	60.8	38.8	38.7
Cereals	29.5	28.8	15.4	14.6	24.5	23.0	8.6	8.2

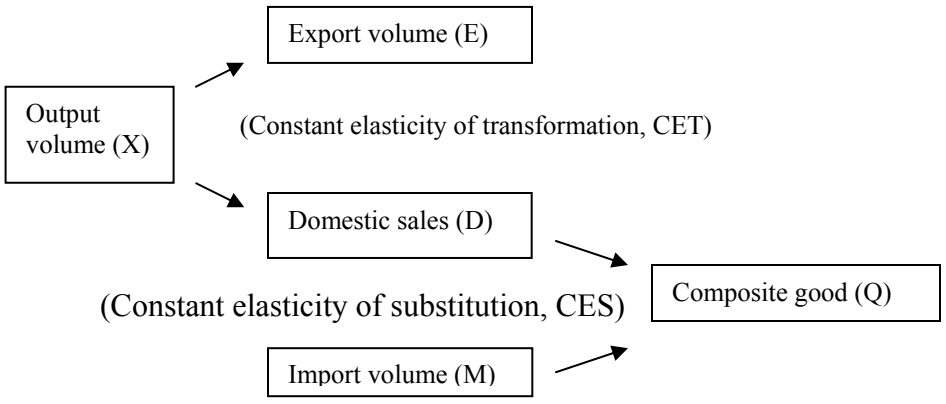
Source: 1997 and 2000 Family Income and Expenditure Survey
* Percent of Total; ** largely rice

4. DATA AND METHODS

4.1 THE MODEL

A CGE model is used to carry out the analysis. An overview of the basic structure of the model is given in Figure 2. The model specifies a transformation function between exports (E) and domestic sales (D) using constant elasticity of transformation (CET). If the export price (Pe) increases relative to the local price (Pl), then export supply will increase while supply for domestic sales will decline. The supply side of the model assumes profit maximization. The first-order conditions for profit maximization generate the necessary supply functions and input demand functions.

Figure 2—The basic model



Prices:

Output price : $Px \cdot X = Pe \cdot E + Pl \cdot D$, where Pl is local prices

Export price: $Pe = Pwe \cdot er$, where Pwe is world price of exports and er is exchange rate

Domestic price: $Pd = Pl \cdot (1 + itx)$, where itx is indirect tax rate

Import price: $Pm = Pwm \cdot er \cdot (1 + tm) \cdot (1 + itx)$, Pwm is world price of imports and tm is tariff rate

Composite price: $Pq \cdot Q = Pd \cdot D + Pm \cdot M$

On the demand side, substitution is specified between imports and domestic goods using a constant elasticity of substitution (CES) function. If the import price in local currency (Pm) declines relative to domestic price (Pd), the demand for imports will increase while demand for local goods will decline. The first-order conditions for cost minimization generate the import and domestic demand functions.

Output price (Px) is the composite of export price (Pe) and local prices (Pl). Indirect taxes are added to the local price to determine domestic prices (Pd), which together with import price (Pm) will determine the composite commodity price (Pq). The composite price is the price paid by the consumers.

The import price (Pm) is in local currency, and is affected by the world price of imports, exchange rate (er), tariff rate (tm), and indirect tax rate (itx). The direct effect of a tariff reduction, for example, is a reduction in Pm. If the reduction in Pm is significant enough, the composite price (Pq) will also decline.

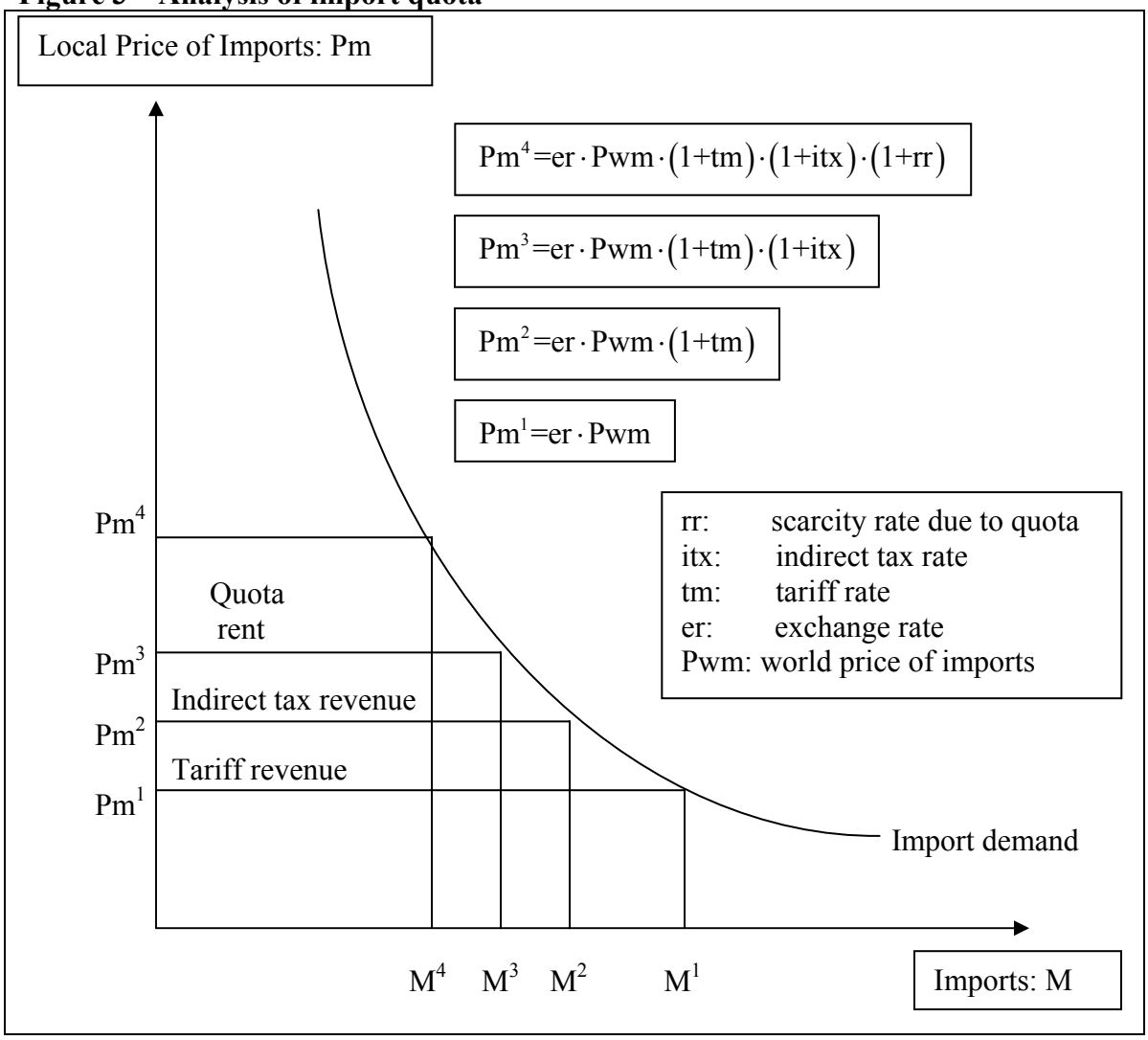
As we have observed above the local price of rice is higher than the price of imported price because of tariff and other distortions such as QR. While tariff can be incorporated in a standard way, it is difficult to introduce QR in the analysis. There are complicated issues in quota modeling (see Francois and Reinert, 1997, for more discussion). For example, while we can identify the restricted quantity of imports, there is usually no certain way of knowing what the level of imports would be if the quota were not in place. Following Francois and Reinert, (1997), we view the effects of QR as price distortion. That is, we adopt a price-gap method of estimating the tariff-equivalent of a

quota. If the domestic price of a good that is under an import quota is compared with its equivalent world price, the price distortion effect of the quota can be computed.

Figure 3 shows the framework we adopted. The vertical axis shows the local price of imports, while the horizontal axis is the import volume. Import demand is downward sloping. Assume horizontal supply. If there is no import distortion, imports will be at M^1. The corresponding price of imports is Pm^1, which is the world price (Pwm) converted to domestic prices using the exchange rate (er). If a tariff (tm) is introduced, then import volume falls to M^2. The price of imports will be Pm^2. If imports are sold in the domestic market, they face an additional indirect tax (itx) similar to other domestic goods sold in the market. In this case, the import volume is reduced to M^3, while its price increases to Pm^3.

Furthermore, if imports are restricted by a quota, say at M^4, then the corresponding price will be higher. Thus, on top of the tariff rate and the indirect tax rate, there is an additional price mark-up due to the scarcity premium, which we call rr. The final local market price of imports will be Pm^4. This distortion will generate three types of revenue: tariff revenue, $(Pm^2 - Pm^1) \times M^4$, and the indirect tax revenue, $(Pm^3 - Pm^2) \times M^4$, both of which will go to the government, and the quota rent, $(Pm^4 - Pm^3) \times M^4$, which will go to the holder of the import rights.

Figure 3—Analysis of import quota



The quota analysis is specified as a mixed-complementarity problem (MCP). The specification is presented in Table 12. Equation (1) is a CES aggregation of imported (M) and domestically produced commodities (D). The resulting good is called the composite commodity (Q). This equation captures product differentiation between (M) and (D). Equation (2) is the first-order condition for cost minimization with (1) as the constraint.

This equation yields the demand for imports. Thus, if the import price (Pm) decreases relative to domestic prices (Pd), imports will increase relative to domestically produced goods. Equation (3) gives the domestic price of imports inclusive of tariffs (tm), indirect tax (itx), and import quota scarcity premium (rr).

Equation (4) defines the price of the composite good (Pq), which is the weighted average of import and domestic prices. Equation (5) is the domestic price (Pd) inclusive of indirect taxes. The local price before indirect tax is (Pl), which is the cost of production of domestically produced goods. Equations (6) and (7) give a complementary slackness relationship between the import quota scarcity premium (rr) and the quota rent (Re). If the quota is not binding, then (rr) is zero; otherwise it has a positive value.

Equation (8) shows the consumer price (Pc), which is equal to the composite price (Pq). Thus, if (rr) is positive, (Pq) is higher, and so is (Pc). Equations (9) and (10) allocate the quota rent to the holders of import rights. In the case of the Philippines, NFA is the major holder of quota rights. However, it issues a very limited number of import licenses to private importers. Thus, household income will increase by its share in the quota rent, while government income will also increase by its share in the rent. The other components of household income (Yh) consist of factor incomes, transfers and other incomes. The other components of government income (Yg) are revenues from taxation, and other incomes.

Table 12—Import quota specified as (MCP)

(1) $Q = \varphi \cdot \left(\mu_m \cdot M^{-\lambda} + \mu_d \cdot D^{-\lambda}\right)^{-1/\lambda}$	: composite good (imported & local goods)
(2) $\frac{M}{D} = \left[\left(\frac{Pd}{Pm}\right) \cdot \left(\frac{\mu_m}{\mu_d}\right)\right]^{1/1+\lambda}$	: demand for imports
(3) $Pm = er \cdot Pwm \cdot (1 + tm) \cdot (1 + itx) \cdot (1 + rr)$	: local price of imports
(4) $Pq = \left(\frac{Pm \cdot M + Pd \cdot D}{Q}\right)$	: price of composite good
(5) $Pd = Pl \cdot (1 + itx)$	: price of local goods
(6) $Re = er \cdot Pwm \cdot (1 + tm) \cdot (1 + itx) \cdot rr \cdot M$	: quota rent
(7) $\left(\overset{*}{M} - M\right) \geq 0$	: import quota
(8) $Pc = Pq$	: consumer prices
(9) $Yh' = Yh + \upsilon_h \cdot Re$	: household income + share in quota rent
(10) $Yg' = Yg + \upsilon_g \cdot Re$	: government income + share in quota rent

The model has 35 production sectors with 13 agricultural sectors including fishing and forestry, 19 industrial sectors, and 3 service sectors, including government service. In the agricultural sector, the model distinguishes fixed capital stock, land and skilled (high school diploma) and unskilled agricultural labor. Non-agricultural sectors have fixed capital and skilled and unskilled non-agricultural workers. The demand for intermediate inputs and value-added represents fixed proportion of total output, while the components of value added are aggregated using a Cobb-Douglas function.

There are 12 household groups in the model broken broadly into urban and rural. Within these broad categories, household classes are defined according to the level of education of head of the family and type of occupation. From the structure of expenditure, sources of income, and poverty indices and poverty distribution presented in

Tables 14, 15, and 22, respectively, there are huge differences across these household groups. For sure, the effects of reforms in trade and in the rice market could vary greatly across these groups in terms of income, consumer prices, and welfare and poverty. Each of urban and rural households is broken down into 6 sub-groups, which are:

1. Low-education salaried: Worked for private household and private establishment; zero education up to third year high school;
2. High-education salaried: Worked for private household and private establishment; high school graduate and up;
3. Civil servants: Worked for government/government corporation;
4. Low-education self employed: Self-employed without employee; zero education up to third year high school; including unemployed during the survey;
5. High-education self employed: Self-employed without employee; high school graduate and up; including unemployed during the survey;
6. Family business: Employed in own family-operated farm or business; worked with pay in own family-operated farm or business; and worked without pay in own family-operated farm or business.

Nominal government consumption, as well as total government income, his held fixed. Any change in government income due to a change in tariff is compensated endogenously by an additional indirect tax. Thus, the government's budget balance (public savings) is endogenously determined.

Total nominal investment is equal to the total real investment, which is held fixed, multiplied by its price. Total real investment is held fixed in order to abstract from inter-temporal welfare/poverty effects. The price of total real investment is endogenous. The propensities to save of the various household groups in the model adjust proportionately to accommodate the fixed total real investment assumption. This is done through a factor in the household saving function that adjusts endogenously.

The current account balance (foreign savings) is held fixed and the nominal exchange rate is the model's numéraire. The foreign trade sector is effectively cleared by changes in the real exchange rate, which is the ratio of the nominal exchange rate multiplied by the world export prices, divided by the domestic price index.

In computing the changes in poverty indices, we utilize the actual distribution of the 2000 Family Income and Expenditure Survey (FIES) within the 12 household categories discussed earlier. These categories are obtained by grouping households in the 2000 FIES which consists of 39,615 households, by region (urban-rural), education and occupation of the head of households. Changes in the average household income are derived for each household category from the CGE model and then applied to all corresponding households in the FIES to compute changes in household poverty.

4.2 ECONOMIC STRUCTURE IN THE MODEL

The sectoral export demand curve elasticities used in the model are the Armington elasticity estimates used in the GTAP model (Hertel and others 2004). The sectoral CES

and CET elasticities in the model are derived as one-half of the Armington elasticities in GTAP (Table 13).

We recalibrated the Philippine model to incorporate a new set of information which include: (a) the 2001 tariff rate on rice imports which is 44.3 percent (Table 10) and the 2001 tariff rates in the GTAP model for the Philippines for the rest of the sectors (Tables 16); (b) the average import-supply ratio for rice over the period 2000-2002 which is about 9 percent (Table 5); and (c) the average ratio between the actual retail price of rice and the price of imported rice at the border over the period 2000-2002 which is about 103 percent (Table 5). The solution of the model with these adjustments serves as the base model to which all subsequent policy simulations are compared.

Total export is composed of 6.43 percent agriculture exports, 61.73 percent industrial exports, and 31.8 percent service sector exports. The principal industrial exports are semi-conductors, and textile and garments. The semi-conductor industry is highly export intensive, followed by coconut processing, bananas, and textile and garment. On the other hand, total import is composed of 98.62 percent industrial imports and 1.38 percent agricultural imports. The sectors which are highly import-intensive are mining (74.5 percent; mainly due to crude oil imports), semi-conductors, machinery, and fertilizer[6]. While agriculture has higher value-added ratio compared to industry, its contribution to the total value added is smaller; 19.87 percent compared to industry which

[6]The Philippines does not produce all items in the semi-conductor sector, but imports some items. For example, it does not have the facilities to produce wafer (motherboard), which is a major part of a computer. Domestic production focuses on hard disk, disk drive, processors, and some chips. Thus, while there substantial domestic production and exports in the semi-conductor sector, there are also substantial imports.

is 31.36 percent and service sector 48.8 percent. Labor intensity is uniformly higher in the agricultural sectors, with the exception of fishing and ‘other livestock’.

Table 13—Elasticities and parameter

	Foreign Trade						Production (%)			
	Elasticities***		Exports,% *		Imports,% *			VA Share	X Share	Lab-Cap
	Armington	CET	Share	Intensities	Share	Intensities	(VA/X)i	(VAi/VA)	(Xi/X)	Ratio**
Irrigated Palay	5.1	5.1			0.0	0.0	73.9	1.8	1.3	0.8
Non-irrigated Palay	5.1	5.1					93.0	0.8	0.4	1.9
Corn	1.3	1.3	0.0	0.3	0.1	3.5	79.7	1.1	0.7	2.0
Banana	1.9	1.9	1.3	59.3			62.9	0.5	0.4	3.3
Fruits	1.9	1.9	0.8	13.9	0.4	6.7	75.9	1.5	1.0	1.7
Coconut	1.9	1.9	0.4	11.0			86.5	1.1	0.7	3.1
Sugarcane	2.7	2.7					71.9	0.6	0.4	1.1
Other agricultural crops	3.2	3.2	0.7	7.5	0.1	1.4	78.4	2.8	1.9	1.5
Hog	2.0	2.0			0.5	6.0	56.0	1.6	1.5	1.1
Chicken, egg & other poultry products	2.0	2.0	0.0	0.1	0.0	0.4	55.6	1.8	1.7	1.0
Other livestock	1.5	1.5	0.0	0.4	0.0	0.6	74.0	1.4	1.0	0.5
Fishing	1.3	1.3	3.2	21.9	0.0	0.2	71.7	3.8	2.7	0.6
Other Agriculture	3.4	3.4			0.1	2.5	77.0	1.0	0.7	2.3
AGRICULTURE			6.4	12.0	1.4	2.1	71.4	19.9	14.2	
Mining	6.3	6.3	2.6	49.4	8.2	74.5	55.0	1.0	1.0	0.9
Meat Processing	4.2	4.2	0.1	0.7	0.9	5.7	28.5	1.4	2.6	0.3
Canning, preserving of fruits & vegetables	2.0	2.0	1.4	31.2	0.2	5.0	36.9	0.6	0.8	0.9
Fish canning & processing	4.4	4.4	2.1	43.5	0.0	0.9	24.5	0.4	0.9	0.8
Coconut processing	2.0	2.0	3.0	66.0	0.4	19.8	22.3	0.4	0.9	1.0
Rice & corn milling	2.6	2.6	0.0	0.1	1.8	9.0	32.3	2.3	3.6	0.2
Sugar milling & refining	2.7	2.7	0.4	10.2	0.2	6.0	30.1	0.4	0.7	0.9
Beverages, sugar, confectionery & others	1.4	1.4	0.2	4.1	0.2	3.8	45.7	0.8	0.9	0.5
Other food manufacturing	2.4	2.4	1.3	6.3	4.6	18.1	29.3	2.2	3.9	0.8
Textile and garments	3.8	3.8	11.8	56.1	8.3	44.7	36.3	2.8	3.9	0.8
Wood_paper products	3.2	3.2	3.7	32.2	5.2	38.5	34.8	1.4	2.1	0.6
Fertilizer	3.3	3.3	0.5	42.3	1.2	63.5	33.5	0.1	0.2	0.5
Other chemicals	3.3	3.3	1.8	13.9	10.0	45.4	40.7	2.0	2.5	0.4
Petroleum_related products	2.1	2.1	1.1	5.9	3.5	16.5	20.2	1.3	3.3	0.5
Metal and related products	3.6	3.6	5.9	48.8	8.3	55.8	23.7	1.0	2.2	0.5
Semi_conductors & other electronic products	4.4	4.4	13.7	75.6	12.4	72.2	24.9	1.6	3.4	0.7
Motor vehicles & other machineries	3.7	3.7	6.1	38.5	24.6	70.4	19.8	1.1	2.9	0.8
Other manufacturing	3.4	3.4	5.7	38.4	8.6	45.7	37.6	2.0	2.7	0.8
Construction and utilities	2.3	2.3	0.4	1.1			52.9	8.2	7.9	0.6
INDUSTRY			61.7	24.7	98.6	39.1	34.4	31.4	46.5	
Wholesale trade	1.9	1.9	13.4	22.1			64.1	14.2	11.3	0.5
Other service	1.9	1.9	18.4	15.5			61.4	26.6	22.1	0.4
Government services							69.0	8.0	5.9	
SERVICES			31.8	17.8			63.0	48.8	39.3	
TOTAL			100.0	20.7	100.0	31.3	51.0	100.0	100.0	

Original source of data: 1194 SAM; ** Lab-Cap is labor-capital ratio not in %; *** GTAP Elasticities for the Philippines.

Table 14 presents a detailed consumption structure of households. The share distribution varies across groups. Agricultural-based consumption (which ranges from 8.3 percent for the 6th urban group to 15.3 percent for the 1st rural group) is relatively smaller than industrial-based consumption (which ranges from 37.8 percent for the 6th urban group to 51.9 percent for the 1st rural group) and service sector-based consumption (which ranges from 32.9 percent for the 1st rural group to 53.9 percent for the 6th urban group). Household consumption of rice and corn, which is under the industrial sector, ranges from 6.2 percent for the 6th urban group to 11.3 percent for the 1st rural group.

Table 15 presents the sources of income of households. Income sources include: labor income from various labor types, sectoral capital income, land income, dividend income, government transfers, and foreign income. The structure of income from these sources varies greatly across household groups.

There are four types of labor in the model: type 1 which is agricultural labor with level of education starting from high school graduate and up; type 2 which is agricultural labor with level of education below high graduate; type 3 which is non-agricultural labor with level of education starting from high school and up; and type 4 which is non-agricultural labor with level of education below high graduate.

Table 14—Consumption share (%)

Sectors	Urban						Rural					
	1	2	3	4	5	6	1	2	3	4	5	6
Irrigated Palay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Non-irrigated Palay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corn	0.2	0.2	0.2	0.2	0.2	0.1	0.3	0.2	0.2	0.3	0.2	0.2
Banana	0.3	0.2	0.2	0.3	0.2	0.2	0.3	0.3	0.2	0.3	0.3	0.3
Fruits	1.7	1.2	1.2	1.6	1.2	1.0	1.8	1.5	1.3	1.8	1.5	1.5
Coconut	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.2
Sugarcane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other agricultural crops	2.2	1.6	1.6	2.0	1.6	1.3	2.3	2.0	1.7	2.3	1.9	2.0
Hog	2.1	1.5	1.5	1.9	1.5	1.2	2.2	1.9	1.6	2.2	1.8	1.9
Chicken, egg & other poultry products	2.7	2.0	2.0	2.5	2.0	1.6	3.0	2.5	2.1	2.9	2.4	2.5
Other livestock	0.6	0.4	0.4	0.6	0.4	0.3	0.6	0.5	0.5	0.6	0.5	0.5
Fishing	4.1	3.0	2.9	3.8	3.0	2.4	4.4	3.7	3.2	4.3	3.6	3.7
Other Agriculture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AGRICULTURE	14.1	10.5	10.1	13.1	10.4	8.3	15.3	12.7	11.1	14.9	12.4	13.0
Mining	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1
Meat Processing	6.8	5.0	4.9	6.3	5.0	4.0	7.3	6.1	5.3	7.2	6.0	6.2
Canning of fruits, vegetables, etc	1.4	1.0	0.9	1.2	0.9	0.8	1.5	1.2	1.1	1.4	1.2	1.2
Fish canning & processing	1.6	1.2	1.2	1.5	1.2	1.0	1.8	1.5	1.3	1.7	1.4	1.5
Coconut processing	0.4	0.3	0.3	0.4	0.3	0.2	0.4	0.4	0.3	0.4	0.4	0.4
Rice & corn milling	10.4	7.8	7.5	9.7	7.7	6.2	11.3	9.4	8.2	11.0	9.2	9.6
Sugar milling & refining	1.2	0.9	0.9	1.1	0.9	0.7	1.3	1.1	1.0	1.3	1.1	1.1
Beverages, sugar, confectionery, etc	2.3	1.6	1.6	2.1	1.6	1.3	2.5	2.1	1.8	2.4	2.0	2.1
Other food manufacturing	11.1	6.8	6.6	9.0	6.4	5.5	12.2	9.7	8.1	10.6	8.9	9.5
Textile and garments	3.4	3.5	3.8	3.4	3.4	3.1	3.8	4.4	4.4	3.9	4.4	4.4
Wood paper products	1.4	1.9	2.1	1.8	2.1	2.2	1.3	1.8	2.0	1.4	1.8	1.7
Fertilizer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other chemicals	3.0	4.0	4.6	3.8	4.3	4.8	2.8	3.9	4.7	3.3	4.1	3.7
Petroleum related products	1.4	1.4	1.3	1.5	1.5	1.2	1.3	1.2	1.1	1.3	1.3	1.1
Metal and related products	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1
Semi-conductors & others	1.0	1.2	1.3	1.1	1.3	1.3	0.9	1.2	1.2	1.0	1.2	1.1
Motor vehicles & other machineries	0.9	1.2	1.2	1.1	1.2	1.2	0.9	1.1	1.2	1.0	1.1	1.1
Other manufacturing	1.3	2.2	1.8	1.5	2.2	2.4	0.9	1.1	1.1	0.9	1.2	1.2
Construction and utilities	1.6	1.6	1.5	1.7	1.8	1.5	1.4	1.4	1.2	1.4	1.5	1.3
INDUSTRY	49.5	41.8	41.6	47.4	42.1	37.8	51.9	47.9	44.2	50.5	46.9	47.5
Wholesale trade	11.4	17.3	16.0	11.2	15.9	20.2	9.4	11.0	13.0	9.1	11.4	11.8
Other service	25.0	30.4	32.3	28.3	31.6	33.8	23.5	28.4	31.7	25.5	29.3	27.8
Government services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SERVICES	36.4	47.7	48.3	39.5	47.4	53.9	32.9	39.4	44.7	34.6	40.7	39.6
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Original source of data: 1994 SAM

*See section 4.1 for definition

Table 15—Sources of household income

	Urban						Rural					
Sources	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**
Agriculture labor, skilled	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.6	6.1	0.0	7.2	5.9
Agriculture labor, unskilled	0.0	0.0	0.0	0.0	0.0	0.0	61.3	0.0	0.7	18.6	0.0	7.4
Production labor, skilled	0.0	66.7	62.7	0.0	26.5	8.7	0.0	52.1	60.5	0.0	20.7	5.1
Production labor unskilled	66.5	0.0	3.7	22.1	0.0	2.9	19.6	0.0	5.1	10.3	0.0	4.5
Capital in agriculture	1.1	0.4	0.8	10.6	2.0	5.2	2.7	1.4	3.8	29.8	17.1	29.4
Capital in industry	0.8	0.7	0.4	2.9	1.9	11.9	0.6	0.4	0.4	2.1	1.8	5.6
Capital in Services	17.7	15.0	18.3	38.3	34.6	54.0	7.1	8.8	9.4	16.9	22.4	23.1
Income from land	0.5	0.4	1.2	1.7	1.3	1.0	0.9	0.8	2.8	2.9	2.8	2.7
Other Income	13.3	16.8	12.9	24.4	33.8	16.3	7.8	7.9	11.1	19.5	28.0	16.2
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Original source of data: 1994 SAM

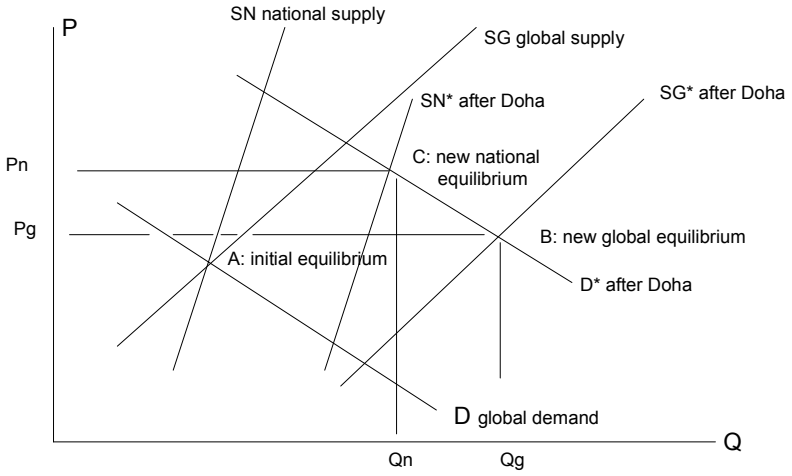
4.3 LINKING THE NATIONAL MODEL TO THE GLOBAL MODEL

The analysis requires linking the global model (GTAP), which simulates DDA and free world trade, and the national model (Philippine CGE model), which simulates the impact on the local economy. This is done following the framework proposed by Horridge and Zhai (2005). Since the national model takes import prices as given, import price changes generated in the global model can be applied as exogenous shocks. Export prices however are different. The analysis is shown in Figure 4. Point A is the point where the supply curve (the SG in the global model and the SN in the national model) intersects the global demand curve, D. Let this be the initial equilibrium. With Doha agreements, global demand expands to D*. This is due to the improvement in market access and the elimination of export subsidies and domestic support. If agriculture is freed from such market distortions, some resources would move from other sectors to agriculture. This would correspondingly expand the global supply to SG*, giving rise to a

new global equilibrium at point B, where the price is Pg and quantity is Qg. On the other hand, for the Philippine model, supply will shift to SN*, giving rise to a new equilibrium at point C, where the price is Pn and the quantity is Qn. Therefore, GTAP model will generate a set of equilibrium points which are different from those generated by the Philippine model.

To implement this link, the following steps were done: (1) Impose the new set of sectoral Armington elasticities of the GTAP model (Hertel, et al 2004) into the sectoral export demand elasticities in the Philippine model; (2) Impose one-half the values of the Armington elasticities of the GTAP into the CES and CET elasticities in the Philippine model; and (3) Impose as shocks the GTAP results on sectoral changes in world prices of Philippine exports and imports, and demand for Philippine exports into the Philippine model.

Figure 4—Linking GTAP with Philippine model



5. POLICY SIMULATIONS

5.1 DEFINITION OF EXPERIMENTS

The GTAP model is run separately to generate estimates of changes in world prices for Philippine exports and imports, demand for Philippine exports, and in the case of the Doha scenario, new Philippine tariff rates[7]. This information is introduced as shocks into the model. Given these socks, the following scenarios are analyzed using the Philippine model:

1. Doha scenario without Philippine trade reform
2. Doha scenario with Philippine reform on tariff and QR
3. Doha scenario with Philippine reform on tariff only
4. Free world trade without Philippine trade reform
5. Free world trade with Philippine reform on tariff and QR

Scenario 1 involves Doha-specified reductions in world and domestic tariff rates, export subsidies and domestic support[8]. Philippine trade reform in Scenario 2 consists of full tariff reduction and elimination of QR on rice imports. Scenario 3 isolates the effects of the elimination of QR on rice imports. Free world trade in Scenario 4 consists of full world trade liberalization which involves elimination of all world and domestic import tariffs. Scenario 5 combines full world trade reform with full Philippine trade reform.

[7] Tariff rate changes are derived from GTAP-estimated variations in the power of tariffs under the Doha scenario. If x is the tariff rate, the power of tariff is p_tm = (1+ x/100). GTAP generates results for p_tm, which in turn is used to compute the new tariff rate.

[8] Scenarios 1 and 4 are similar but not the same experiments conducted in Cororaton, Cockburn and Corong (2005). They differ in the incorporation of import quota analysis in the base run in the present paper.

Table 16 summarizes the 2001 tariff rates for the Philippines, as well as the variations in world import and export prices, world export demand and Philippine import tariff rates as estimated by the GTAP model. The export price and volume changes can be combined with knowledge of the slope of the export demand schedule to compute the vertical shift in export demand that is used in the Philippine model (Cororaton, Cockburn and Corong, 2005).

Table 16—GTAP-Simulated world prices and demand variations (percent)

Sectors	2001 GTAP Tariffs for Philippines	Doha-SDT* Export Price	Doha-SDT* Export Volume	Doha-SDT* Import Price	Doha-SDT* New Tariff**	Free World Trade Export Price	Free World Trade Export Volume	Free World Trade Import Price
Agriculture								
Irrigated Palay	20.9	0.0	201.0	3.4	20.9	-4.5	1586.0	8.3
Non-irrigated Palay	20.9	0.0	201.0	3.4	20.9	-4.5	1586.0	8.3
Corn	25.7	0.2	3.7	1.8	22.6	-1.6	35.4	8.4
Banana	8.9	-0.3	-6.4	0.8	7.6	-1.9	-6.3	2.2
Fruits	8.9	-0.3	-6.4	0.8	7.6	-1.9	-6.3	2.2
Coconut	8.9	-0.3	-6.4	0.8	7.6	-1.9	-6.3	2.2
Sugarcane	0.0	0.7	-23.1	1.4	0.0	-1.5	-33.1	2.3
Other agricultural crops	4.7	0.3	-0.8	1.9	4.7	1.9	49.9	8.2
Hog	3.0	0.5	-7.9	2.3	3.0	-0.7	39.4	6.6
Chicken, egg & other poultry products	3.0	0.5	-7.9	2.3	3.0	-0.7	39.4	6.6
Other livestock	5.9	0.1	-0.4	1.4	5.0	-1.5	10.8	4.4
Fishing	4.1	0.4	0.4	0.6	4.1	1.4	2.5	2.1
Other Agriculture	0.1	0.2	0.3	0.6	0.0	2.0	2.3	1.8
Industry								
Mining	3.1	0.6	0.1	0.1	3.1	1.0	2.0	0.7
Meat Processing	17.8	0.1	41.5	0.7	14.3	-0.4	172.3	0.0
Canning of fruits, vegetables, etc	6.2	0.4	3.8	0.5	6.1	0.5	16.9	0.6
Fish canning & processing	30.2	0.1	36.7	0.0	20.6	-0.4	170.8	-2.3
Coconut processing	6.2	0.4	3.8	0.5	6.1	0.5	16.9	0.6
Rice & corn milling	49.9	0.1	-36.0	0.1	49.9	-2.1	-24.6	6.8
Sugar milling & refining	46.7	0.5	56.5	4.8	39.2	0.3	188.4	6.7
Beverages, sugar, Confectionery, etc	11.1	0.3	22.7	1.1	10.4	0.5	108.8	2.6
Other food manufacturing	5.2	0.4	2.5	1.9	5.2	1.1	12.3	3.0
Textile and garments	6.6	0.5	10.8	0.3	6.6	-0.7	44.9	0.7
Wood paper products	4.7	0.3	-2.0	0.3	4.7	0.6	3.8	1.1
Fertilizer	4.5	0.2	6.2	0.1	4.5	-0.6	28.6	0.4
Other chemicals	4.5	0.2	6.2	0.1	4.5	-0.6	28.6	0.4
Petroleum related products	2.7	0.1	1.5	0.1	2.7	-2.0	13.3	-0.2
Metal and related products	3.9	0.3	-2.7	0.2	3.9	1.0	-3.8	0.6
Semi conductors & others	0.1	0.2	-1.6	0.1	0.1	0.5	-3.4	0.4
Motor vehicles & other machineries	4.0	0.2	-0.5	0.2	3.9	-0.3	9.0	0.5
Other manufacturing	5.1	0.3	-3.8	0.3	5.1	0.6	-2.1	0.9
Construction and utilities	0.0	0.3	-1.3	-0.1	n.a.	1.3	-3.6	0.2
Service								
Wholesale trade	0.0	0.3	-0.8	0.2	n.a.	1.1	-1.6	1.0
Other service	0.0	0.3	-1.1	0.0	n.a.	1.7	-4.5	0.4
Government services	0.0	0.3	-1.1	0.0	n.a.	1.8	-5.4	0.2

*SDT is special differential treatment; **calculated using the change in the power of tariff derived from the GTAP results;
n.a = not applicable

Given the agricultural focus of DDA, it is important to note that almost all Philippine trade is industrial in nature, although food processing represents some 8.6 percent of total export (Table 13). With the exception of fruit, world export prices increase slightly (by less than 1 percent) under the Doha scenario, whereas variations are greater and more often negative, in the case of full liberalization. Much more substantial impacts are noted in terms of world demand for Philippine exports, particularly under full liberalization. These impacts are strongly positive for palay[9], textiles and garments and a number of processing industries (meat/fish processing, sugar and beverages). However, they are moderately negative for several agricultural products (fruit, sugarcane, and in the case of the Doha scenario, livestock) and certain manufacturing and service sectors. On the import side, world prices increase for almost all imports, with the strongest increases among agricultural goods and under full liberalization. The changes in Philippine tariff rates are minimal under the Doha scenario because these reductions apply to bound tariff rates, which are much higher than the applied tariff rates.

The net impacts of these changes on the agricultural sector, which is the source of income for most of the poor are difficult to anticipate a priori. Although world prices and demand fall for a number of agricultural exports, reduced import competition (higher world import prices) and increased world prices and demand for agro-industrial exports are likely to have positive effects on domestic demand for agricultural goods. We now turn our attention to the simulation results from our CGE model to try to sort out these (and other) different effects and determine the net poverty impacts.

[9]As palay export is zero at the base, these large percentage increases will have no impact on the results.

5.2 SIMULATION RESULTS

The macro effects are presented in Table 17. The effects of the Doha-only scenario are small. There is practically no change in the overall tariff in the Philippines.[10] On average, export prices increase by 0.5 percent, slightly higher than the import price increase of 0.2 percent. This leads to relatively higher increase in export volume of 0.3 than import volume of 0.1 percent. Output, consumption and other domestic prices increase because of the increase in export and import prices.

Table 17—Macro effects (% change from base)

	Doha			Full Trade Reform	
		with Philippine reform		Full World	with Philippine
	Doha only	Tariff + QR	Tariff only	Trade Reform	trade reform
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Overall Philippine nominal tariff rate	0.1	-100	-100	0.0	-100
Domestic prices					
Imports	0.2	-3.3	-2.5	0.6	-3.0
Exports	0.5	-0.6	-0.1	2.0	1.0
Domestically-sold production	0.4	-3.1	-1.0	1.6	-1.8
Total Production	0.4	-3.8	-1.5	1.7	-2.5
Consumption	0.3	-3.5	-1.3	1.4	-2.4
Real exchange rate change, %	0.0	2.7	1.6	0.4	3.0
Domestic volumes					
Imports	0.1	8.2	2.9	0.7	8.2
Exports	0.3	5.8	3.5	1.7	7.5
Domestically-sold production	0.0	-1.8	-1.0	0.1	-1.7
Total Production	0.0	-0.2	0.0	0.1	-0.1
Consumption	0.07	0.15	-0.08	0.27	0.31

[10] The tariff change of 0.08 percent comes from the power of tariff factor explained in footnote 8.

If the Doha scenario is combined with Philippine trade reform consisting of tariff reduction across sectors and elimination of QR on rice imports, the effects are relatively larger. Import prices decline by -3.3 percent if both domestic policies are incorporated and -2.5 percent if the sectoral tariff reduction is the only one present. The difference is the effect of QR elimination, which is smaller in the overall import price (-3.3 – (-2.5) = -0.8), but larger in the consumption price (-3.5 – (-1.3) = -2.2). This is due to a smaller weight of rice import in the import structure (1.8 percent in Table 13) and a larger weight of rice in the consumption structure (Table 14). However, the impact on import volume is significantly higher in the combined domestic reform (8.2 percent) than in the tariff reduction only (2.9 percent). The difference again comes from the elimination of rice QR. There is a surge of rice imports if QR is eliminated as we shall see in the discussion of the sectoral results.

The impact on domestic prices of the elimination of Philippine trade distortions is larger than the increase in export and import prices under the Doha-only scenario. The impact is larger if both sectoral tariff reduction and QR elimination are combined. As a result of lower domestic prices, real exchange rate depreciates. The results indicate a clear switch in producers' preferences from domestic sales (-1.8 percent) to exports (5.8 percent). However, the displacement effect on domestic production of higher imports is slightly higher than the effects of higher export volume, as indicated by a small change in the overall output in both trade reform scenarios.

The effects on sectoral prices and volumes[11] are presented in Table 18. The small macro effects of the Doha-only scenario generate small sectoral effects as well. We shall not delve into the details of the sectoral results in this scenario because these have already been discussed elsewhere[12], instead we shall highlight that there is a small reallocation affects from inward-oriented agriculture to export-oriented industry, largely because of the relatively higher export effects of the Doha scenario on the Philippines.

All sectoral price indicators decline under the Scenario 2. One of the most significant effects is the reduction in the import price of rice and corn milling of -47.9 percent and irrigated palay of -13 percent. Consumer price of rice and corn milling drops by -23.1 percent and irrigated palay by -11.2 percent. Output and value added prices of both decline at higher rates. Imports of rice surge by 237.3 percent, creating displacement effects on domestic production. Production of rice declines by -9.5 percent and irrigated palay by -9.0 percent. Despite the drop in domestic production of rice, however consumption improves by 22.6 percent because of the surge in rice imports.
If we compare the results in Scenario 2 (tariff and QR) with those in Scenario 3 (tariff only), we can observe that the large effects on rice and palay in the former are mainly due to the elimination of rice QR.

The sectoral effects of full world trade liberalization in Scenario 4 are higher than in the Doha-only scenario. If we combine Philippine trade reform in Scenario 5, the sectoral effects are relatively smaller than in Scenario 2.

[11]To save space, we only presented results of the various scenarios for palay and rice and broad sectors. The complete set of results is available from the author upon request
[12] See Cororaton, Cockburn and Corong, 2005.

The effects on factor prices are presented in Table 19. The Doha-only experiment in Scenario 1 results in positive but small change in factor prices. However, a free world trade in Scenario 4 also results in positive, but larger effects on factor prices.

The impact of Philippine trade reform leads to biased effects against prices of factors used in agriculture. Because of larger reduction in output prices and volume in agriculture relative to industry in Scenario 2 (Table 18), the drop in agricultural wages[13], return to capital in agriculture, and return to land is much bigger than the decline in prices of factors used in non-agricultural sectors. Furthermore, the larger negative effects on factor prices in Scenario 2 are due to the elimination of QR. This is because of the smaller negative effects in Scenario 3 where tariff reduction is only considered.

[13] The effects on skilled and unskilled agricultural wages are the same because of similar factor intensity used.

Table 18—Effects on prices and volumes by major sectors (percent change from base year)

Sectors	Prices						Volume Changes (%)						
	Import	Export	Dom.	Cons.	Output	VA	Import	Export	Dom.	Cons.	Output	VA	Labor
Scenario 1. Doha without Philippine trade reform													
Agriculture	1.0	-0.2	0.5	0.5	0.5	0.5	-1.5	-1.9	0.2	0.2	0.0	0.0	0.0
Irrigated Palay	3.5		0.3	0.3	0.4	0.4	-14.7		0.1	0.1	0.1	0.1	0.1
Non-irrigated Palay			0.3	0.3	0.4	0.4			0.0	0.0	0.0	0.0	0.1
Industry	0.2	0.7	0.3	0.3	0.4	0.7	0.1	0.9	0.0	0.1	0.2	0.1	0.4
Rice & corn milling	0.4	-5.3	0.4	0.4	0.4	0.7	0.0	-14.2	0.1	0.1	0.1	0.1	0.2
Service		0.1	0.4	0.4	0.4	0.4		-0.5	0.0	0.0	0.0	0.0	-0.2
Total	0.2	0.5	0.4	0.3	0.4	0.5	0.1	0.3	0.0	0.1	0.0	0.0	
Scenario 2. Doha with Philippine trade reform (Tariff + QR)													
Agriculture	-3.3	-2.6	-5.7	-5.7	-6.8	-8.3	-7.2	6.6	-1.3	-1.4	-0.6	-0.7	-1.1
Irrigated Palay	-13.0		-11.2	-11.2	-12.5	-15.8	1.2		-9.0	-9.0	-9.0	-9.0	-16.4
Non-irrigated Palay			-10.3	-10.3	-11.7	-12.3			-7.5	-7.5	-7.5	-7.5	-11.5
Industry	-3.3	-0.1	-2.7	-3.6	-3.5	-4.9	8.4	6.7	-2.4	1.3	-0.4	-0.4	-0.8
Rice & corn milling	-47.9	-9.3	-13.6	-23.1	-14.9	-30.6	237.3	7.0	-9.5	22.6	-9.5	-9.5	-35.3
Service		-1.0	-2.2	-2.2	-3.2	-3.7		4.0	-1.3	-1.3	-0.3	-0.3	-1.0
Total	-3.3	-0.6	-3.1	-3.5	-3.8	-4.9	8.2	5.8	-1.8	0.1	-0.2	-0.2	
Scenario 3. Doha with Philippine trade reform (Tariff only)													
Agriculture	-3.8	-1.2	-1.5	-1.6	-2.4	-2.8	2.6	1.3	-0.4	-0.3	-0.2	-0.2	-0.4
Irrigated Palay	-13.5		-1.9	-1.9	-2.9	-3.4	88.9		-0.4	-0.4	-0.4	-0.4	-0.9
Non-irrigated Palay			-2.1	-2.1	-3.1	-3.2			-0.3	-0.3	-0.3	-0.3	-0.5
Industry	-2.5	0.2	-1.2	-1.7	-1.6	-1.5	2.9	4.8	-1.7	0.2	0.0	-0.1	-0.2
Rice & corn milling	-1.2	-6.1	-1.1	-1.1	-2.0	-2.4	0.0	-10.7	-0.4	-0.3	-0.4	-0.4	-1.7
Service		-0.4	-0.5	-0.5	-1.2	-1.4		1.5	-0.5	-0.5	-0.1	-0.1	-0.4
Total	-2.5	-0.1	-1.0	-1.3	-1.5	-1.7	2.9	3.5	-1.0	-0.1	0.0	0.0	

Table 18—Effects on prices and volumes by major sectors (percent change from base year) con't.

Sectors	Prices						Volume Changes (%)						
	Import	Export	Dom.	Cons.	Output	VA	Import	Export	Dom.	Cons.	Output	VA	Labor
Scenario 4. Full world trade liberalization without Philippine trade reform													
Agriculture	5.1	0.6	2.4	2.5	2.4	2.8	-5.2	-4.6	0.6	0.5	0.1	0.1	0.2
Irrigated Palay	8.1		2.2	2.2	2.4	2.7	-24.9		0.1	0.1	0.1	0.1	0.3
Non-irrigated Palay			2.3	2.3	2.5	2.6			0.0	0.0	0.0	0.0	0.0
Industry	0.5	2.7	1.3	1.1	1.7	2.4	0.8	3.7	-0.1	0.2	0.4	0.4	1.0
Rice & corn milling	2.0	-4.3	2.0	2.0	2.1	2.3	0.0	-15.4	0.1	0.1	0.1	0.1	0.5
Service		0.9	1.6	1.6	1.6	1.8		-1.3	0.2	0.2	-0.1	-0.1	-0.2
Total	0.6	2.0	1.6	1.4	1.7	2.2	0.7	1.7	0.1	0.3	0.1	0.0	
Scenario 5. Full world trade liberalization with Philippine trade reform													
Agriculture	0.1	-1.7	-3.8	-3.7	-4.9	-6.0	-9.8	3.3	-0.8	-1.0	-0.5	-0.5	-0.9
Irrigated Palay	-9.2		-9.0	-9.0	-10.3	-13.2	-7.3		-8.1	-8.1	-8.1	-8.1	-14.9
Non-irrigated Palay			-8.2	-8.2	-9.4	-10.0			-6.9	-6.9	-6.9	-6.9	-10.5
Industry	-3.0	1.8	-1.7	-2.8	-2.3	-3.1	8.4	9.9	-2.5	1.4	-0.1	-0.2	-0.1
Rice & corn milling	-44.6	-8.1	-11.4	-20.2	-12.6	-27.2	209.8	4.3	-8.6	20.3	-8.6	-8.6	-32.4
Service		-0.2	-1.0	-1.0	-2.0	-2.3		3.0	-1.1	-1.1	-0.3	-0.3	-1.1
Total	-3.0	1.0	-1.8	-2.4	-2.5	-3.2	8.2	7.5	-1.7	0.3	-0.1	-0.2	

Dom = domestic sales of local production; cons. = consumption (domestic); VA = value added; n.c. = not computed

Table 19—Factor prices (percent change from base)

	Doha			Full Trade Reform	
		with Philippine reform		Full World	with Philippine
Factors	Doha only	Tariff + QR	Tariff only	Trade Reform	reform
Average wage	0.5	-4.0	-1.4	2.0	-2.5
Agriculture labor, skilled	0.4	-8.6	-3.1	2.6	-6.5
Agriculture labor, unskilled	0.4	-8.6	-3.1	2.6	-6.5
Production labor, skilled	0.4	-2.5	-1.0	1.6	-1.3
Production labor unskilled	0.7	-3.7	-1.2	2.4	-1.9
Average return to capital in all sectors	0.5	-5.3	-1.8	2.3	-5.5
Return to capital in agriculture	0.6	-8.0	-2.8	3.2	-3.9
Return to capital in industry	0.8	-5.9	-1.7	2.7	-2.6
Return to capital in service	0.3	-4.0	-1.5	1.7	-3.5
Return to land	0.4	-14.0	-3.4	2.7	-11.5

What are the effects on household income? In Table 20, we present the effects on income as well as on the weighted consumer price of each of the household groups. Because of the positive factor price effects under the Doha-only scenario (Scenario 1), the impact on income is positive across all household groups. The effects on consumer prices are positive as well. Except for household group 1, the rest of the groups see higher positive consumer price effects than income effects.

Because of declining factor prices in Scenario 2, all household groups experience declining income. However, the results vary across groups. Rural household group 1 has the largest drop in income of -6.7 percent, while urban household group 2 has the smallest drop of -2.4. One can observe also that, generally, rural household groups have much higher reduction in income than urban households. This is due to the biased effects against factor prices used in agriculture.

Table 20—Household income and consumer price effects (percentage change from base)

	Doha						Full Trade Reform			
			with Philippine Reform				without Philippine reform		with Philippine reform	
	Doha only		Tariff + QR		Tariff only					
	Total Income	Consumer Prices	Total Income	Consumer Prices	Total Income	Consumer Prices	Total Income	Consumer Prices	Total Income	Consumer Prices
	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5	
Urban										
1	0.5	0.4	-3.4	-5.6	-1.1	-1.3	2.0	1.8	-1.9	-4.1
2	0.3	0.4	-2.4	-4.7	-0.9	-1.1	1.3	1.7	-1.4	-3.3
3	0.4	0.4	-2.7	-4.6	-1.0	-1.1	1.4	1.7	-1.6	-3.3
4	0.4	0.4	-3.6	-5.3	-1.2	-1.2	1.7	1.7	-2.2	-3.9
5	0.3	0.4	-2.5	-4.7	-0.9	-1.1	1.2	1.7	-1.6	-3.3
6	0.4	0.4	-3.6	-4.2	-1.3	-1.1	1.7	1.6	-2.3	-2.9
Rural										
1	0.4	0.4	-6.7	-5.9	-2.3	-1.3	2.3	1.8	-4.8	-4.4
2	0.4	0.4	-4.4	-5.3	-1.6	-1.2	1.8	1.7	-3.0	-3.9
3	0.4	0.4	-3.4	-4.9	-1.2	-1.2	1.6	1.7	-2.1	-3.5
4	0.4	0.4	-5.4	-5.8	-1.9	-1.3	2.1	1.8	-3.8	-4.3
5	0.3	0.4	-3.8	-5.2	-1.4	-1.2	1.6	1.7	-2.6	-3.8
6	0.4	0.4	-5.3	-5.3	-1.9	-1.2	2.1	1.7	-3.6	-3.9

Note: Household groups are defined as follows:
[1] Low-education salaried
[2] High-education salaried
[3] Civil servants
[4] Low-education self employed
[5] High-education self employed
[6] Family business
See section 4.1 for more information.

The reduction in sectoral tariff and the elimination of QR result in a reduction in consumer prices. The impact varies across household groups because of differences in the structure of expenditure. One can observe that for all urban household groups the drop in consumer prices are higher than the decline in income. This is not the case for rural household groups where the first group sees higher reduction in income than the reduction in consumer prices.

In Scenario 3, all rural household groups experience relatively larger reduction in income than consumer prices. This is not the case in urban households where reduction in prices is higher than the reduction in income, except for the 6th group.

Table 21—Real income effects (percent)

	Tariff + QR	Tariff only	Difference
	(1)	(2)	(1)-(2)
Urban			
1	2.2	0.1	2.1
2	2.3	0.2	2.1
3	1.9	0.1	1.8
4	1.8	0.0	1.8
5	2.2	0.3	1.9
6	0.5	-0.2	0.8
Rural			
1	-0.8	-1.0	0.2
2	0.9	-0.3	1.2
3	1.5	0.0	1.5
4	0.3	-0.6	0.9
5	1.4	-0.1	1.5
6	0.0	-0.6	0.6

Note: Household groups are defined as follows:
[1] Low-education salaried
[2] High-education salaried
[3] Civil servants
[4] Low-education self employed
[5] High-education self employed
[6] Family business
See section 4.1 for more information.
*change in nominal income less change in consumer prices

A free world trade without Philippine trade reform (Scenario 4) will bring about higher income and consumer prices for all household groups. It is interesting to note that under this scenario only two rural household groups (3 and 5) experience an increase in income which is relatively lower than the increase in consumer prices. In the case of

urban households, four groups (2, 3, 4, 5), have lower increase in income than consumer prices.

The results under Scenario 5 are similar to Scenario 2, except that the magnitude of change in household income and consumer prices are relatively smaller. This is because of the higher change in Scenario 4 than in Scenario 1.

Table 21 compares the real income effects across households of the reduction in tariff and the elimination of rice QR. Column (1) is the difference between the change in income and consumer prices under Scenario 2, while Column (2) is the difference under Scenario 3. The third column is the difference between (1) and (2), which captures the effects of the elimination of QR. The results indicate positive effects for all household groups, which imply positive real income effects of eliminating QR, but vary across groups. The impact on rural households is generally smaller than on urban households.

The effects on poverty are measured using the change in the Foster-Greer-Thorbecke (FGT) indices before and after the economic shock. The FGT poverty measure is:

$$P_{\alpha} = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z - y_i}{z}\right)^{\alpha}$$

where n is population size, q number of people below poverty line, y_i is income, z is the poverty threshold. Poverty threshold is equal to the food threshold plus the non-food threshold, where threshold refers to the cost of basic food and non-food requirements. The parameter α can have three values, each one indicating a measure of poverty (see Ravallion, 1992, for discussion). The headcount index of poverty has $\alpha = 0$. This is the

common index of poverty, which measures the proportion of the population whose income (or consumption) falls below the poverty threshold. The poverty gap index has $\alpha = 1$. This measures the depth of poverty in the sense that it indicates how far below on average the poor are from the poverty threshold. The poverty severity index has $\alpha = 2$. This measure is sensitive to the distribution among the poor as more weight is given to the poorest below the poverty threshold. This is because the poverty severity index corresponds to the squared average distance of income of the poor from the poverty line, hence gives more weight to the poorest of the poor in the population.

In the FGT calculations, poverty effects come from two sources: (i) from the change in household income; and (ii) from the change in consumer prices, which affects the nominal value of the poverty line. Both of these changes are derived from the CGE analysis, which are averages for each of the household groups in the model. We applied these results to the 2000 Family Income and Expenditure (FIES) survey to get the change in poverty indices.

The results are presented in Table 22. The table also presents the actual poverty indices in 2000. The overall poverty headcount index is 34 percent. Rural poverty is higher at 48.8 percent than urban poverty at 18.6 percent. Rural poor comprises 73.2 percent of all poor households, while urban poor 26.8 percent only. Among rural households the poorest is the 4th group with poverty headcount index of 53.5 percent. This group has 45.8 percent of all poor households. The next poorest is the 1st rural

household group with poverty headcount index of 51.3 percent and which comprises 18.3 percent of all poor households.

The effects of the Doha-only scenario are small and generally not poverty-reducing. Except for the 1st urban group which experiences a slight reduction in poverty indices, all household groups have higher poverty index. The 6th rural group, however, has slightly lower poverty gap and severity indices under this scenario.

The poverty effects of Scenario 2 where Philippine trade reform is incorporated are mixed and generally favorable to urban households. All urban household groups have lower poverty. The largest reduction in the poverty headcount index is in the 2nd urban group. For rural households, two groups have favorable poverty effects, 3 and 4, with the former having poverty declining by -4.3 percent. The 1st rural group, which is one of the poorest groups, has higher poverty. Similar pattern is observed in poverty gap and severity.

The results under Scenario 3 where tariff reduction is only considered indicate that the effects are not generally poverty-reducing in terms of the poverty headcount index. Only the 1st and the 3rd urban groups have slightly favorable poverty effects. The 1st rural group has the highest poverty increase of 1.8 percent. In terms of the poverty gap and severity, the impact is even more unfavorable to rural households.

We subtracted the results of Scenario 3 from Scenario 2 to get an indication of the poverty effects of eliminating QR. The results indicate is that eliminating QR is poverty-reducing. Almost all groups have negative difference, which implies that the price reduction effects dominate the negative income effects. The difference in the poverty gap

and severity indices is even larger, which implies that those who are far below the poverty threshold would have even more favorable impact.

While a generally similar pattern is observed in Scenarios 4 and 5, we take note that the two poorest household groups, the 4th and the 1st rural groups, have favorable poverty effects under the full world trade scenario. If we incorporate Philippine trade reform under Scenario 5, the reduction in poverty for the 4th rural group is slightly higher than in Scenario 2. The 1st rural group though still has an increase in poverty.

The above analysis is based on a static one-period model, capturing only inter-sectoral movement of resources as a result of changes in relative prices within one period. Movement of resources across period and how it affects factor prices and household income is not captured. While these dynamic effects are important, they are difficult to anticipate a priori. Without an explicit dynamic model, it is difficult to disentangle the overall effects on households.

Rice is grown in various parts of the country where there are substantial cost differences because of high transaction cost. As such, this is an important issue to consider. However, it has to be modelled explicitly before one gains meaningful insight of its effects. For sure there are available frameworks that can be adopted to capture the effect of this factor, but this is beyond the scope of the present paper.

Table 22—Poverty effects (percentage change from poverty in 2000)

	Doha						2000	2000
		with Philippine Reform			Full Trade Reform		Poverty	Poverty
	Doha only	Tariff + QR	Tariff only	Difference	Full Trade + Phil reform		Index	Distribution
		(1)	(2)	(1) - (2)				
Poverty Headcount								
Urban	0.0	-3.9	-0.1	-3.8	-0.1	-3.7	18.6	26.8
1	-0.1	-4.5	-0.2	-4.4	-0.5	-4.5	23.6	10.0
2	0.0	-8.5	0.0	-8.5	0.0	-5.9	3.1	0.3
3	0.3	-6.0	-0.9	-5.1	0.3	-5.2	7.9	1.2
4	0.0	-3.3	0.0	-3.3	0.1	-3.0	22.8	13.6
5	4.3	-7.4	0.0	-7.4	5.3	-4.7	3.7	0.3
6	0.0	-1.8	0.0	-1.8	0.0	-1.8	14.0	1.4
Rural	0.1	0.1	1.0	-0.9	-0.4	-0.3	48.8	73.2
1	0.0	1.6	1.8	-0.1	-0.5	1.0	51.3	18.3
2	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.1
3	0.0	-4.3	0.0	-4.3	0.0	-4.0	17.2	1.3
4	0.1	-0.3	0.7	-1.0	-0.3	-0.7	53.5	45.8
5	0.0	0.0	0.0	0.0	0.0	0.0	23.8	0.6
6	0.0	0.0	1.0	-1.0	-0.3	-0.3	40.9	7.1
All	0.1	-1.0	0.7	-1.6	-0.3	-1.2	34.0	100.0
Poverty Gap								
Urban	0.0	-5.3	-0.1	-5.2	-0.1	-5.1	5.0	
1	-0.3	-6.5	-0.4	-6.2	-0.6	-6.6	6.1	
2	0.2	-10.6	-1.1	-9.5	1.4	-9.0	0.6	
3	0.1	-6.0	-0.5	-5.6	0.6	-5.3	1.9	
4	0.1	-4.7	0.0	-4.7	0.2	-4.3	6.4	
5	0.6	-10.1	-1.0	-9.1	2.4	-8.2	0.7	
6	0.0	-1.3	0.5	-1.8	-0.1	-1.3	4.3	
Rural	0.0	-0.1	1.5	-1.6	-0.7	-0.6	15.9	
1	0.0	1.9	2.3	-0.4	-1.1	0.9	16.3	
2	0.1	-1.8	0.7	-2.5	-0.1	-1.8	1.7	
3	0.1	-4.4	0.0	-4.5	0.2	-4.0	4.5	
4	0.0	-0.7	1.2	-1.9	-0.6	-1.1	18.0	
5	0.2	-3.0	0.3	-3.3	0.3	-2.6	7.6	
6	0.0	-0.1	1.4	-1.5	-0.8	-0.7	12.6	
All	0.0	-1.3	1.1	-2.4	-0.6	-1.7	10.6	

Note: Household groups are defined as follows:

[1] Low-education salaried

[2] High-education salaried

[3] Civil servants

[4] Low-education self employed

[5] High-education self employed

[6] Family business.

See section 4.1 for more information.

Table 22—Poverty effects (percentage change from poverty in 2000) continuation

	Doha				Full Trade Reform		2000 Poverty Index	2000 Poverty Distribution
	Doha only	with Philippine Tariff + QR	Tariff only	Reform Difference	Full Trade	+ Phil reform		
		(1)	(2)	(1) - (2)				
Poverty Severity								
Urban	-0.1	-5.9	-0.2	-5.8	-0.1	-5.6	2.0	
1	-0.3	-7.4	-0.4	-7.0	-0.7	-7.4	2.3	
2	0.6	-11.3	-1.3	-10.1	1.9	-9.4	0.2	
3	0.1	-6.9	-0.6	-6.3	0.7	-6.1	0.7	
4	0.1	-5.4	0.0	-5.4	0.2	-5.0	2.6	
5	1.0	-10.5	-1.0	-9.4	2.6	-8.4	0.2	
6	0.0	-1.4	0.5	-1.9	-0.2	-1.4	1.9	
Rural	0.0	-0.1	1.9	-2.0	-0.9	-0.8	6.9	
1	0.1	2.3	2.9	-0.6	-1.4	1.1	6.9	
2	0.0	-2.7	0.9	-3.6	-0.3	-2.6	0.7	
3	0.1	-4.6	0.1	-4.7	0.2	-4.2	1.8	
4	0.0	-0.9	1.6	-2.5	-0.8	-1.4	7.9	
5	0.3	-4.1	0.4	-4.5	0.4	-3.6	3.0	
6	0.0	-0.1	1.8	-1.9	-1.0	-0.9	5.1	
All	0.0	-1.4	1.4	-2.8	-0.8	-1.9	4.5	

Note: Household groups are defined as follows:

[1] Low-education salaried
[2] High-education salaried
[3] Civil servants
[4] Low-education self employed
[5] High-education self employed
[6] Family business

See section 4.1 for more information.

* 2000 Family Income and Expenditure Survey

6. SUMMARY AND CONCLUSION

The objective of the paper is to examine the effects on poverty, particularly rural poverty, of trade reform which consists of tariff reduction across sectors and elimination of QR on rice imports within the DDA and a free trade world economy. We adopted a two-step approach wherein we utilized the simulation results of the GTAP model concerning the possible effects of changes in world trading arrangements on Philippine foreign trade, and then translated these to determine the impact on the local economy and poverty using a CGE model.

Rice is the staple food for about 80 percent of Filipinos, and is therefore a major item in the consumption basket of consumers. It is the single most important agricultural crop in the Philippines, and is therefore a major source of income for millions of Filipino farmers. Because of its political significance, the government is heavily involved both in its supply and distribution to assure consumers a sufficient and stable supply at low prices and to maintain a reasonable return to rice farmers with adequate price incentives. The government, through the NFA, procures palay from the farmers and injects rice to stabilize the market. Based on recent data, NFA's procurement from the farmers is less than 1 percent of total production, while its injection into the market is about 13 percent of total supply. These interventions created market distortions in rice. Our estimates indicate that:

(a) the actual retail price of ordinary rice is 70 percent higher than the cost of processed rice;

(b) the actual price of imported rice at the border is about 13 to 15 percent lower than the cost of producing rice domestically;

(c) the retail price is about 100 percent higher than the border price of rice, of which about 44 percent is due to tariff while the rest to other distortions such as the QR.

We conducted five experiments analyzing various combinations of DDA and free world trade with Philippine trade reform. We observed that the impact of the Doha-only scenario on the Philippines is very small. Although small, the biased effects against the inward-oriented agriculture sector are evident. Industrial export increases, while agricultural export contracts.

The impact of Philippine trade reform which consists of full tariff reduction across sectors and elimination of rice QR magnifies the biased effects against the inward-oriented agricultural sector. The main driver of the reallocation effects that favor the industrial sector is the increase in exports. The increase in industrial export originates from the Doha scenario and from the real depreciation of the exchange rate. The latter is largely due to the reduction in domestic prices as a result of reduction in tariff and elimination of rice QR. Since the industrial sector dominates exports, the increase in its export volume is significantly higher than agricultural exports. Thus, prices of factors used intensively in agriculture fair below those used in the industrial sector. Therefore, rural households that rely heavily on agriculture-related activities fair below as well relative to urban households that depend on the industrial sector.

We attempted to separate the effects of eliminating rice QR and observed that the reduction in consumer prices dominates the reduction in nominal income across all

household groups. Thus, eliminating rice QR itself is poverty-reducing. However, the reduction in poverty is higher among urban households than among rural households.

A free world trade scenario will benefit the Philippines in terms of higher export prices and export demand, which will minimize the biased effects against agriculture sectors. Thus, rural households would benefit in terms of higher income and poverty reduction. However, if a free world trade scenario is coupled with a full Philippine trade reform, the results switch back to the previous biased effects against agriculture.

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APPENDIX: MODEL SPECIFICATION

Equations	Description
$x_i = \upsilon_i \cdot va_i$	Output
$inp_i = \eta_i \cdot x_i$	Intermediate input
$id_{j,i} = a_{j,i} \cdot inp_i$	Matrix of intermediate input
$va_c = \tau_c \cdot l_c^{\alpha_c} \cdot k_c^{\beta_c} \cdot ld_c^{\gamma_c}$	Value added for crops
$va_{nc} = \tau_{nc} \cdot l_{nc}^{\alpha_{nc}} \cdot k_{nc}^{\beta_{nc}}$	Value added for non-crops
$l_i = \vartheta_i \cdot \prod_n l_i^{\alpha n_i}$	Labor Aggregation function
$l_i \cdot w_i = va_i \cdot pva_i \cdot \alpha_i$	Aggregate labor
$l_i^n \cdot w^n = l_i \cdot w_i \cdot \alpha_i^n$	Labor type n, where n=1,2,4
$w_i \cdot l_i = \sum_n w^n \cdot l_i^n$	Average wage
$ld_c \cdot rld = va_c \cdot pva_c \cdot \gamma_c$	Land
$x_i = \mu_i \cdot (\theta_i \cdot e_i^{\kappa\_e_i} + (1-\theta_i) \cdot d_i^{\kappa\_e_i})^{(1/\kappa\_e_i)}$	CET: output, exports, domestic demand
$\mathrm{e}_i = d_i \cdot \left[\frac{pe_i}{pl_i} \cdot \frac{1-\theta_i}{\theta_i} \right]^{\tau\_e_i}$	Exports
$x_i = \xi_i \cdot (\delta_i \cdot m_i^{-\rho\_m_i} + (1-\delta_i) \cdot d_i^{-\rho\_m_i})^{(-1/\rho\_m_i)}$	Armington
$m_i = d_i \cdot \left[\frac{pd_i}{pm_i} \cdot \frac{1-\delta_i}{\delta_i} \right]^{\sigma\_m_i}$	Imports
$\left(m^*_{rice} - m_{rice} \right) \geq 0$	Rice quota
$re = pwm_{rice} \cdot er \cdot (1+tm_{rice}) \cdot (1+itxr_{rice}) \cdot (1+ntaxr) \cdot rr \cdot m_{rice}$	Quota rent
$ct_h = dyh_h - savh_h$	Total consumption of each household
$ch_{i,h} \cdot pq_i = \omega_{i,h} \cdot ct_h$	Commodity demand of each household
$inv_i \cdot pq_i = \psi_i \cdot tinv\_n$	Investment demand
$ind_i = \sum_j id_{i,j}$	Intermediate demand

Equations	Description
$tinv\_n = pinv \cdot tinv\_r$	Nominal total investment
$yl^n = \sum_i w^n \cdot l^n{}_i$	Type n labor income
$yld = \sum_c rld \cdot ld_c$	Land income
$yk = \sum_i r_i \cdot k_i$	Capital income
$yh_h = \left((\sum_n \Omega_{n,h} \cdot yl^n) + \eta_h \cdot yld + \pi_h \cdot ywa + \varepsilon_h \cdot yk \right) + \left(\Phi_h \cdot div + trgov_h + yfor_h \cdot er + \Xi_h \cdot sh \cdot re \right)$	Household income
$dyh_h = yh_h \cdot (1 - dtxr_h)$	Disposable income
$yf = \varepsilon_f \cdot yk \cdot (1 - dtxr_f)$	Firm income
$tmrev = \sum_i tm_i \cdot m_i \cdot er \cdot pwm_i$	Tariff revenue
$itxrev = \left(\sum_i ((itxr_i + 1) \cdot ntaxr + ntaxr) \cdot d_i \cdot pl_i \right) + \left(\sum_i ((itxr_i + 1) \cdot ntaxr + ntaxr) \cdot m_i \cdot pwm_i \cdot er \cdot (1 + tm_i) \right)$	Indirect tax revenue
$dtxrev = \sum_h dtxr_h \cdot yh_h + \varepsilon_f \cdot yk \cdot dtxr_f$	Direct tax revenue
$yg = tmrev + itxrev + dtxrev + grant\_for \cdot er + sh_g \cdot re$	Government revenue
$savh_h = \sigma_h \cdot dyh_h$	Household savings
$savf = yf - div - div\_for$	Firm savings
$savg = yg - g - \sum_h trgov_h - paygv\_for$	Government savings
$pinv = \prod_i \left(\frac{pq_i}{\psi_i} \right)^{\psi_i}$	Price of Investment
$pm_i = pwm_i \cdot er \cdot (1 + tm_i) \cdot (1 + itxr_i) \cdot (1 + ntaxr) + pwm_{rice} \cdot er \cdot (1 + tm_{rice}) \cdot (1 + itxr_{rice}) \cdot (1 + ntaxr) \cdot (1 + rr)$	Import price
$pe_i = pwe_i \cdot er$	Export price
$pq_i \cdot q_i = pd_i \cdot d_i + pm_i \cdot m_i$	Composite price

Equations	Description
$px_i \cdot x_i = pl_i \cdot d_i + pe_i \cdot e_i$	Export price
$pd_i = pl_i \cdot (1 + itxr_i) * (1 + ntaxr)$	Domestic price
$pva_i \cdot va_i = px_i \cdot x_i - \sum_j id_{j,i} \cdot pq_j$	Price of value added
$r_i \cdot k_i = pva_i \cdot va_i - w \cdot l_i - rld \cdot ld_i$	Return to capital
$q_i = \sum_h ch_{i,h} + inv_i + ind_i$	Product market equilibrium
$tinv\_n = \sum_h savh_h + savf + savg + cab$	Savings-Investment
$cab = \sum_i pwm_i \cdot m_i \cdot er + div\_for + paygv\_for$ $-\sum_i pwe_i \cdot e_i \cdot er - \sum_h yfor_h \cdot er - grant\_for \cdot er$	Current account
$ls^n = \sum_i l^n{}_i$	Equilibrium in type n labor
$lds = \sum_i ld_i$	Equilibrium in land

Index: i, j: sectors;
h: household groups;
n: labor types;
c: crops;
nc : non-crops

Note: All Greek letters are parameters

Variables:

Variable	Description	Variable	Description
x_i	output	$id_{i,j}$	matrix of intermediate inputs
va_i	value added	inp_i	intermediate inputs
ld_i	land	l_i	aggregate labor
ln_i	labor type n	d_i	domestic demand
e_i	exports	m_i	imports
m*	rice quota	re	quota rent
rr	rate of quota rent	q_i	composite good
ct_h	total consumption of h	$ch_{i,h}$	commodity consumption of h
inv_i	investment demand	ind_i	intermediate demand
g	government consumption	tinv_n	total nominal investment
tinv_r	total real investment	yl^n	labor income of type n
yd	land income	yh_h	household income
yk	capital income	dyh_h	disposable income
dtxrev	direct income tax revenue	itxrev	indirect tax revenue
tmrev	tariff rate revenue	yg	government income
$savh_h$	household savings	savf	firm savings
savg	government savings	w	average wage rate
w^n	wage rate of labor type n	rld	return to land
pinv	price of investment	pl_i	local price
pm_i	import price	pe_i	export price
pq_i	composite price	px_i	output price
pd_i	domestic price	pva_i	price of value added
r_i	return to capital	ntaxr	compensatory indirect tax
ls	supply of aggregate labor	ls^n	supply of labor type n
lds	supply of land	k_i	capital stock
div	dividend paid to local investors	div_for	dividend paid to foreign investors
$trgov_h$	government transfers to household	y_for_h	foreign income of households
paygv_for	Gov't payments to rest of the world	grant_for	rest of the world grant to government
pwm_i	world import price	pwe_i	world export price
er	exchange rate	cab	current account balance
$dtxr_h$	direct income tax rate for household	dtxrf	direct income tax rate for firms
$itxr_i$	indirect tax rate	tm_i	tariff rate

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